

## **Surgical treatment of spontaneous pneumothorax associated with lobal emphysema in a dog**

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### *Abstract*

A 3-year-old female Maltese dog was admitted with cough, dyspnea, and gasping. There was no sign of trauma in history taking. It was speculated that pneumothorax occurred in the right pleural space after X-ray examination. Thoracocentesis and chest tube were applied for 5 days. The symptoms of dyspnea and cough were, however, not relieved or recurred. Exploratory thoracotomy was considered to be the most appropriate approach. Spongiform and air-containing tissue was identified in the whole parenchyma in the right middle lobe. Total lobectomy was performed and then a chest tube was inserted. Atrophy of the right cranial lobe and collapse in the right caudal lobe were identified. In histopathological examination, loss of alveolar septa and dilated alveolar ducts were demonstrated. The patient showed no abnormal symptoms, and the X-ray examination showed no signs of recurrence after surgery. This report describes a rare spontaneous pneumothorax case which is associated with lobal emphysema in an adult dog, but not in puppies with congenital lobar emphysema.

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**Keywords:** spontaneous pneumothorax, lobectomy, emphysema, dog

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## Introduction

Pneumothorax is a pathologic condition characterized by accumulation of air in the pleural space resulting in collapse of the lung lobes. Pneumothorax can be classified as open or closed and as traumatic, spontaneous, or iatrogenic. Spontaneous pneumothorax is defined as closed pneumothorax resulting from leakage of air from the lung parenchyma itself without any history of trauma (Holtzinger et al., 1993). Other sources include the trachea, bronchi, and esophagus or gas-forming organisms within the pleural cavity. Traumatic pneumothorax is common in dogs, whereas spontaneous pneumothorax is relatively rare (Holtzinger et al., 1993; Yoshioka, 1982; Valentine et al., 1996). Spontaneous pneumothorax can be further classified as either primary or secondary based on history, clinical signs, and whether an underlying cause can be determined from diagnostic tests, such as thoracic radiographs, thoracic computed tomography, or thoracoscopy (Holtzinger et al., 1993; O'Neill, 1987; Tanaka et al., 1993). Reasons for spontaneous pneumothorax in dogs include pulmonary blebs or bullous emphysema, lobar emphysema, bacterial pneumonia, pulmonary abscesses, dirofilariasis, and neoplasia (Busch and Noxon, 1992; Oliveira et al., 2010; Puerto et al., 2002; Saheki et al., 1981). Based on previous reports, the most common cause of spontaneous pneumothorax is pulmonary blebs or bullae. Authors have suggested on the basis of recommendations published in human literature that dogs with spontaneous pneumothorax could be treated without surgery by use of a combination of intermittent thoracocentesis or tube thoracostomy and strict rest (Yoshioka, 1982). Results of more recent retrospective studies have suggested that earlier surgical intervention is associated with lower recurrence rates and higher success rates in dogs with spontaneous pneumothorax (Puerto et al., 2002).

Here, a rare case of spontaneous pneumothorax associated with lobar emphysema in an adult dog is reported.

## Materials and Methods

A 3-year-old female Maltese dog was admitted with cough, dyspnea, and gasping. At the time of admission, the patient showed a respiratory rate of 60 breaths per minute, inspiratory dyspnea and goose honking in the form of exertional respiration; these symptoms had started 3 days earlier. There was no sign of trauma in history taking. CBC and Chemistry found no particular abnormality. After X-ray examination, it was speculated that pneumothorax occurred in the right pleural space, and the patient was stabilized through thoracocentesis. Three hours after thoracocentesis, the symptoms of dyspnea and cough recurred and a chest tube was inserted. During 5 days of hospitalization, ventilation pattern and air leakage from the chest tube were measured. Additional radiographs were also taken in order to check for pneumothorax recurrence. It was confirmed that air was present in the thoracic cavity even after chest tube insertion, and it led to the decision for a surgical intervention. General anesthesia was induced with

acepromazine (0.02 mg/kg SC; Sedaject®, Samu median, Chungcheonnam-Do, Korea) and propofol (5 mg/kg IV; Provive 1%, Myungmoon Pharm, Hwaseong, Korea). After inducing anesthesia, the patient was intubated and positive pressure ventilated. Inhalation anesthesia was maintained with isoflurane in oxygen.

After anesthesia stabilization, the patient was placed in lateral recumbency and the previously inserted chest tube was removed. The thoracic cavity was exposed through the right 8<sup>th</sup> intercostal, and the Finochietto retractor was used to give appropriate exposure. It was identified that the right caudal lung lobe collapsed. The right middle lobe was not composed of normal tissue but was a spongiform, air-containing lobe. In order to find air bubbles and detect leakage in the lung lobe, warm and sterile saline was filled in the thoracic cavity with positive pressure ventilation. Air bubble was detected in the parenchyma of the right middle lung lobe. In addition, atrophy of the right cranial lobe was identified. Total lobectomy was performed after double ligation of the pulmonary vasculature and bronchus with green polyester suture materials. Through positive pressure ventilation, the right caudal lobe was confirmed to inflate normally. After removing the fluid, a chest tube was inserted and the thoracic cavity was closed. Two days after surgery, it was removed from the chest.

## Results and Discussion

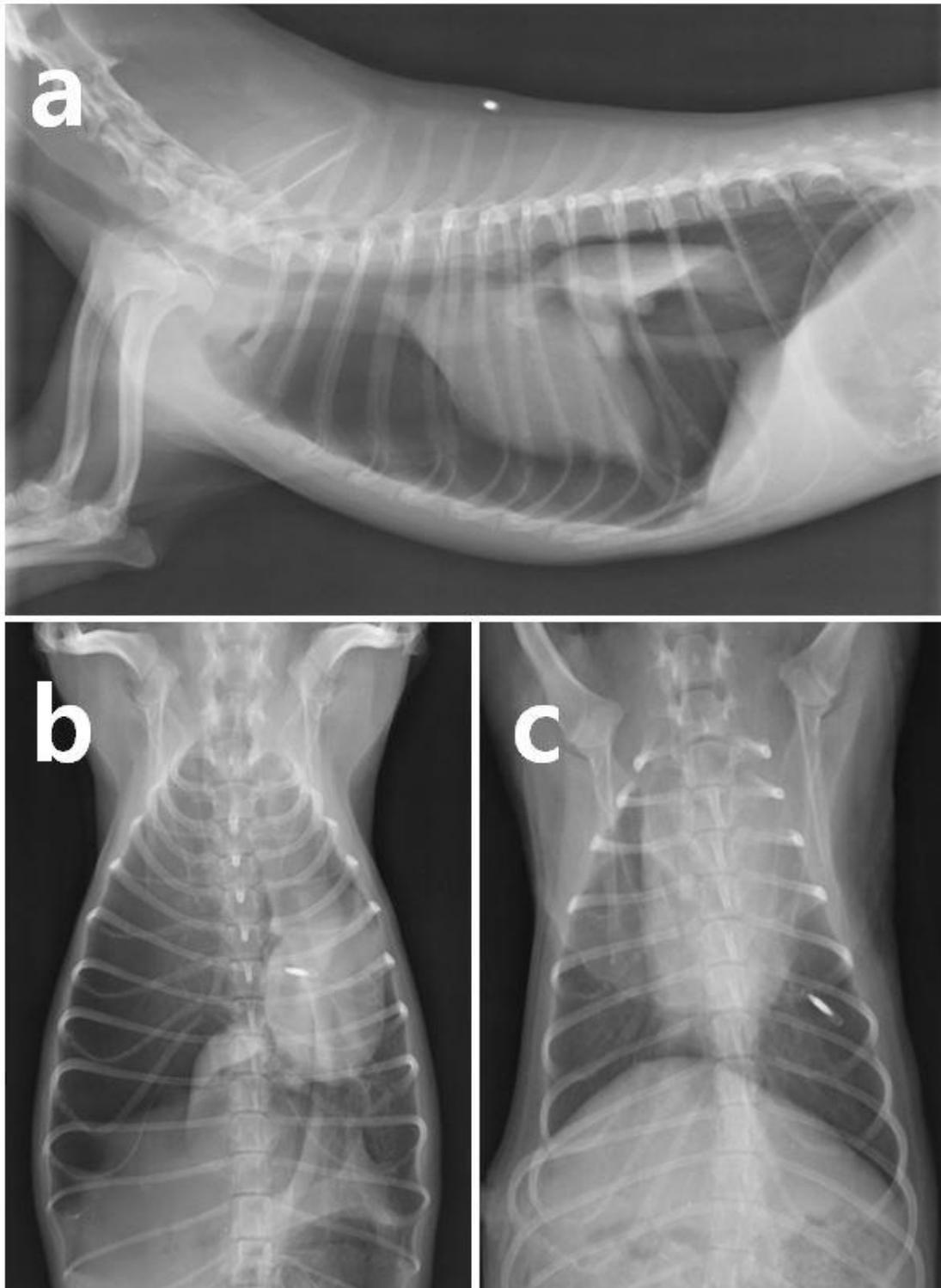
Seventeen days after the surgery, the patient showed no abnormal symptoms, and the X-ray examination showed no signs of recurrence. Non-traumatic spontaneous pneumothorax was considered in this case by several examinations. Exploratory thoracotomy was performed and atrophy of the right cranial lobe and collapse in the right caudal lobe were identified. Therefore, total lobectomy was performed in order to reduce the possibility of recurrence. In the excised middle lobe, spongiform, air-containing tissue was identified in the whole parenchyma. Rupture of alveolar septa and dilated alveolar ducts were demonstrated in histological examination.

There was no other lesion in the lung sample that could explain the non-traumatic pneumothorax in this patient. In this case, typical causes such as pneumonia, pulmonary abscess, neoplasia, chronic granulomatous infection, pulmonary parasitic infection were ruled out after histopathologic examination and bacterial culture. It was diagnosed as spontaneous pneumothorax associated with emphysema by the histopathologic examination. Several cases of lobar emphysema are reported, and it mainly affects puppies under a year of age (Billet and Sharpe, 2002; Herrtage and Clarke, 1985; Matsumoto et al., 2004; Mitchell and Nykamp, 2006; Tennant and Haywood, 1987). The right middle lung lobe was most commonly affected, followed by the left cranial lobe (Mitchell and Nykamp, 2006). Lung emphysema is only and rarely detected in dogs, and cysts are occasionally ruptured producing spontaneous pneumothorax (Silverman et al., 1976). Congenital lobar emphysema in dogs is usually associated with

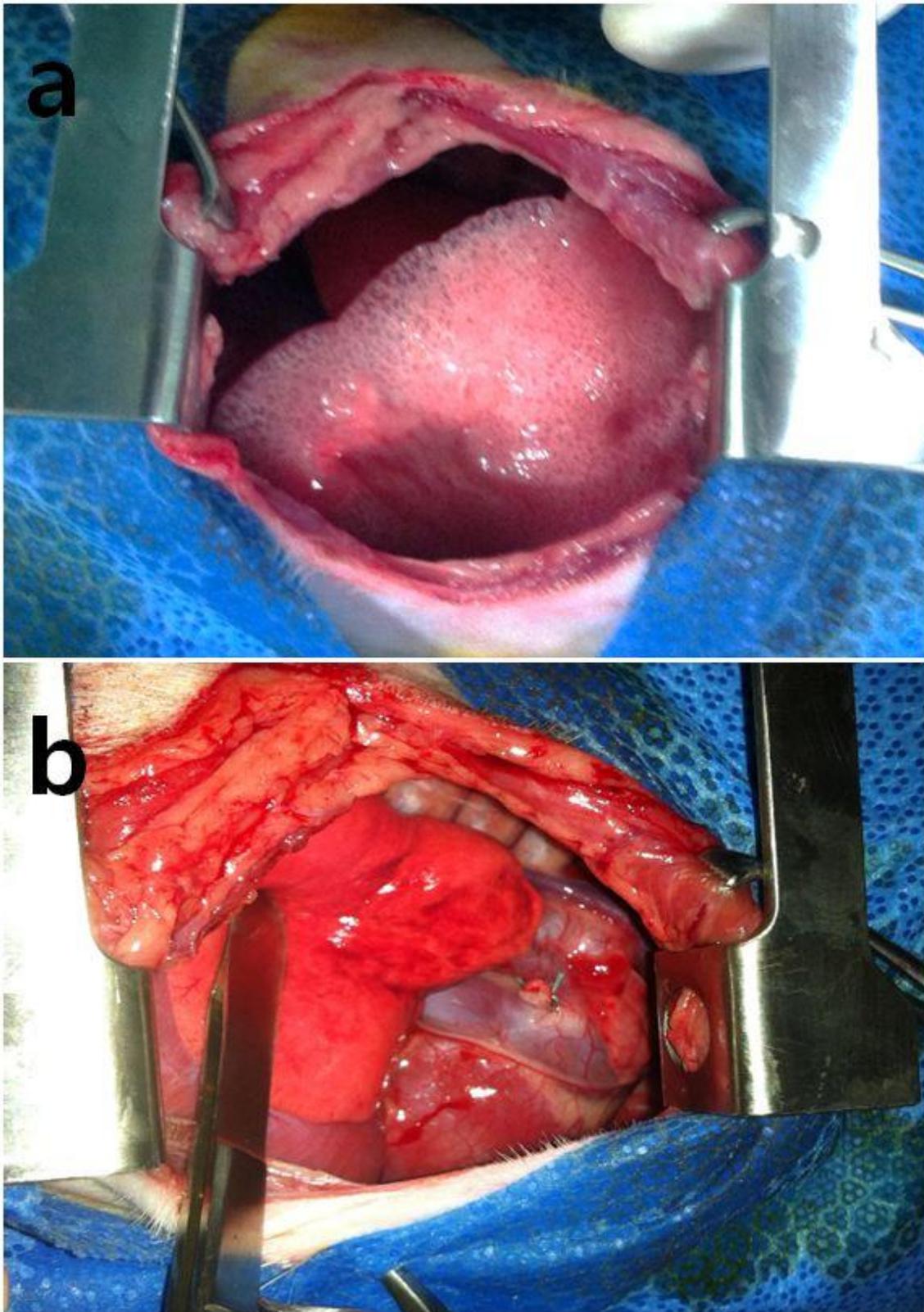
cartilage dysplasia or hyperplasia (Mitchell and Nykamp, 2006).

Reasons for the idiopathic emphysema in our case of 36 months could not be found. Spontaneous pneumothorax associated with emphysema is rare in adult dogs, but the diagnosis and surgical treatment

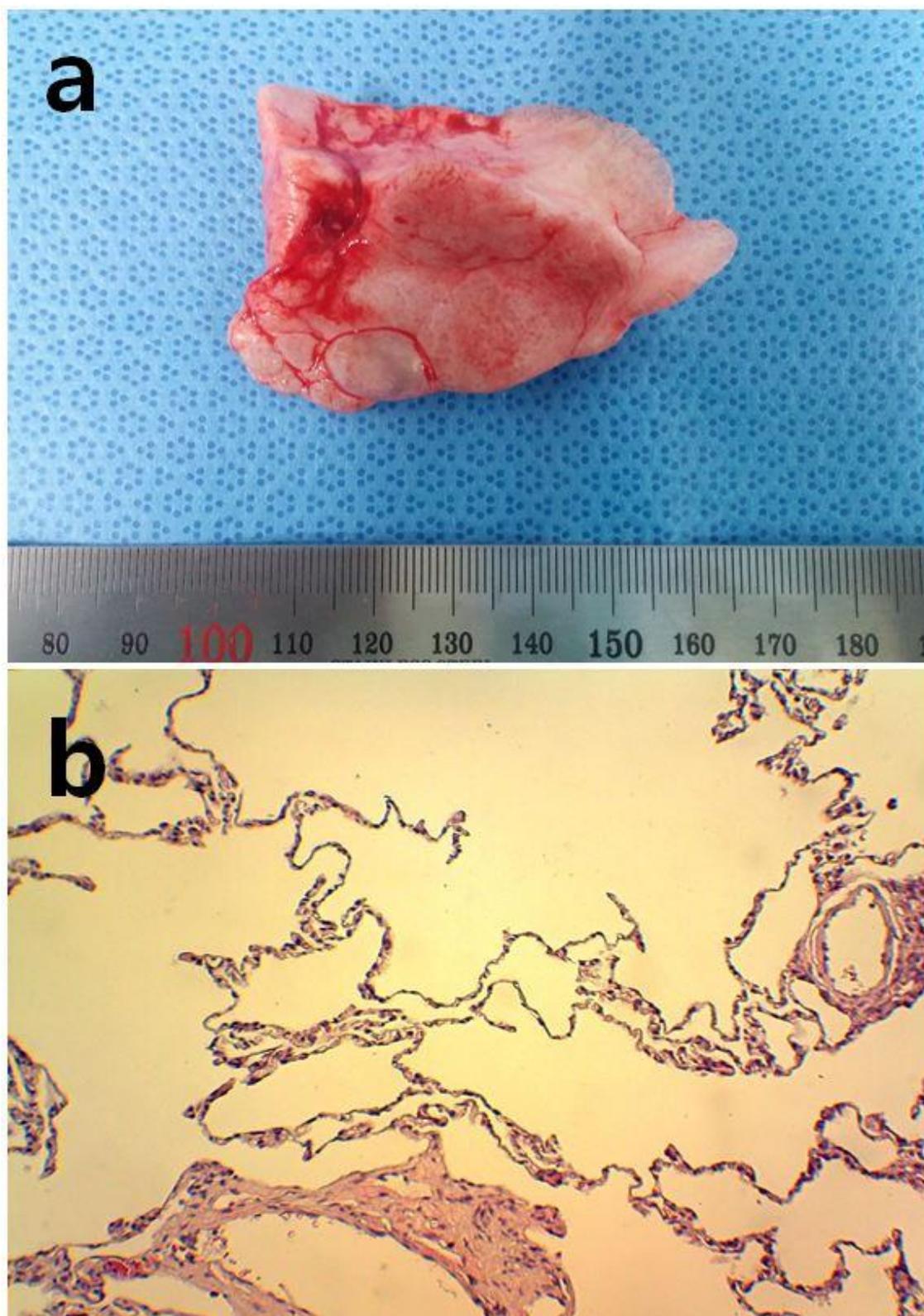
are relatively easy. Exploratory thoracotomy should be considered as one of the most important treatments for spontaneous pneumothorax after early detection of abnormalities with radiography and/or computed tomography.



**Figure 1** Pneumothorax occurred in the right side when the patient came to hospital (a, b). The patient showed no abnormal radiological signs at 17 days after surgery (c).



**Figure 2** Spongiform and air-containing right middle lung lobe was identified in operation (a). Atrophy of the right cranial lobe was identified (b).



**Figure 3** Spongiform and air-containing tissue was identified in the whole parenchyma in the excised middle lobe (a). Rupture of alveolar septa and dilated alveolar ducts were demonstrated in histological examination (b).

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## บทคัดย่อ

### การผ่าตัดรักษาภาวะลมในช่องอกที่เกิดขึ้นเอง และภาวะถุงลมโป่งพองในสุนัข

ยาวอน ฮวัง ซึงวอน ยู กอนยง คิม\*

สุนัขหมอลตาเพศเมียอายุ 3 ปี เข้ารับการรักษาด้วยอาการไอหายใจลำบากและหายใจไม่ออก ไม่มีร่องรอยของการบาดเจ็บ หลังการตรวจร่างกายและเอ็กซเรย์พบ ลมในช่องอก (pneumothorax) ในบริเวณเยื่อหุ้มปอดด้านขวา ทำการรักษาโดยการเจาะทรวงอกและใส่หลอดทรวงอกนาน 5 วัน สุนัขยังคงมีอาการหายใจลำบากและไอ แต่อาการไม่เกิดมากขึ้น จากนั้นตรวจวินิจฉัยโดยเปิดเจาะช่องอก ซึ่งเป็นวิธีที่เหมาะสมที่สุด พบเนื้อเยื่อสปองจิฟอร์ม และอากาศอยู่ในเนื้อเยื่อชั้นในทั้งสองข้างของปอดด้านขวากลาง จึงพิจารณาคัดเนื้อปอดและ ใส่หลอดทรวงอก พบการยุบตัวของปอดด้านขวาบนและล่างเพิ่มขึ้น ผลการตรวจทางพยาธิวิทยาแสดงให้เห็นถึงการสูญเสียเส้นแบ่งถุงลม และการขยายตัวของท่อถุงลม อย่างไรก็ตามสุนัขไม่แสดงอาการผิดปกติ และผลการตรวจเอ็กซเรย์ไม่พบสัญญาณของการเป็นซ้ำหลังการผ่าตัด รายงานฉบับนี้อธิบายภาวะลมในช่องอก ที่เกิดขึ้นเองซึ่งหาได้ยาก ซึ่งส่วนใหญ่เกี่ยวข้องกับภาวะถุงลมโป่งพองในสุนัขโต แต่ไม่พบในลูกสุนัขที่มีภาวะถุงลมโป่งพองแต่กำเนิด

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